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OFFICE OF
PREVENTION PESTICIDES AND
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Memorandum

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SUBJECT: Benefits Assessment for Diazinon Use on Tomatoes: Impacts of Cancellation

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SUMMARY

Yield loss attributed to the cancellation of diazinon in fresh tomato production is 1.3%. No significant economic impact should result from diazinon cancellation.

SCOPE AND LIMITATIONS OF ASSESSMENT

The scope of this assessment was based on information related to fresh tomato production states and evidence of diazinon usage. While greenhouse tomatoes are generally produced for the fresh market, analysis of greenhouse tomato production is not included in this analysis. This mitigation scenario is in response to the health risks identified by the Health Effects Division of the Office of Pesticide Programs for applicators.

There are limits to this assessment. Tomatoes for the fresh market are produced throughout the United States. However, insecticide usage data is only available for a few select states. Examination of available data indicates that Florida is the only state treating more than 2% of fresh tomato production acres with diazinon.¹ Therefore, this analysis will concentrate on production data and diazinon use for the state of Florida. In addition, this assessment is limited to fresh tomatoes in general and does not consider usage variances between specific varieties. It is assumed that producers will not shift to alternate crops. This analysis also assumes that farm gate prices are not affected by any changes at the grower level and that growers do not drastically alter their production practices. This analysis will focus solely on operation costs, ignoring overhead and other opportunity costs, which can be difficult to measure and are beyond the scope of this exercise. Thus, net cash returns overstate actual profits to the grower.

FRESH TOMATO PRODUCTION

Average U.S. fresh tomato production from the years 1996-2000 was about 3.5 billion pounds with an average aggregate value slightly exceeding one billion dollars (Table 1). An overwhelming majority of production occurs in two states, California and Florida. In 2000, these states accounted for approximately 66% of total acreage and 72% of total production of fresh tomatoes nationally. Eighteen other states reported fresh tomato production, but in significantly minor quantities. The leading states in this second tier include Virginia (3.5%), Tennessee (3%) and Ohio (3%) (See appendix).

Table1. U.S. Average Area, Production, and Value of Production: 1996-2000.²

Area Harvested (Acres)	Yield per Acre (cwt.)	Production (1,000 cwt)	Value per Unit (\$ per cwt.)	Value of Sales (\$ 1, 000)
123,772	279	34,548	30.00	1,049,660

USE OF DIAZINON IN FRESH MARKET TOMATO PRODUCTION

The usage pattern for diazinon on fresh market tomatoes for the last 10 years are presented in Table 2. Percent crop treated and application rates have remained virtually the same over the 10 year period. The number of applications, however, have declined dramatically since 1992. This may reflect less use as a foliar spray for aphid control. In addition, the total amount of diazinon traditionally applied for fresh market tomato production has decreased 70% since 1996.

Table 2. Historical usage pattern for diazinon on fresh market tomatoes.^{1,3,4,5,6}

Year	Acres treated (%)	Applications (number)	Application rate (lbs per acre)	Total applied (lbs)
1992	3	6.6	0.48	9,000
1994	5	2.6	0.63	9,200
1996	6	2.5	1.09	14,300
1998	2	2.0	0.67	2,100
2000	4	1.4	0.58	4,300
Average	4	3.02	0.69	7,780

Data reflecting diazinon use tomatoes in most fresh tomato producin states is lacking. Of the 14 reporting states in 2000, representing 92% of national production, only 5 states indicated use of diazinon in fresh market tomato production (Table 3).

Table 3. State usage of diazinon on fresh market tomatoes in 2000.¹

State	Area Applied (%)	Applications (#)	Rate per Applicati on (lbs per acre)	Total Applied (lbs)
Florida ¹	7	1.4	0.58	2,400
Georgia ¹	<1	2.8	0.42	50
Michigan ¹	2	2.0	0.48	<50
Texas ¹	2	5.2	0.54	100
California ^{2,7}	2	N/a	0.52	433

A total of 4,300 lbs of diazinon were applied for fresh market tomato production in 2000. Of this total, Florida use accounted for 55.8% of all diazinon usage. When considering that over 128,000 acres in the US were in fresh tomato production in 2000, diazinon use appears to be minimal.

TARGET PESTS IN FRESH TOMATO PRODUCTION

Diazinon is used primarily to control soil insect pests in fresh market tomato production. These

pests include mole cricket and wireworm. In the past, diazinon was also used to control aphids but has been reported to no longer provide as effective control as other products, primarily due to insect resistance.

Mole Crickets

Mole crickets are the primary pest targeted for control with diazinon in fresh tomato production. Mole crickets are commonly found around the perimeter of a vegetable field and will migrate into the field as the soil fumigants dissipate off and as the growing season progresses.⁸ Therefore, if a field of young seedlings is adjacent to a field or pasture that is infested with mole crickets it will be at risk. Mole crickets can increase populations by directly feeding upon the crop or by feeding on weeds that colonize between the crop rows. Smaller vegetable seedlings appear to be very susceptible to feeding damage and the soil disruption caused by the tunneling activity of the mole crickets. Larger transplants appear to be more tolerant. Mole crickets feed on tomato plant roots and during warm, wet nights they may feed upon the stems and occasionally the leaves at the soil surface. The feeding damage is commonly referred to as cutworm-like in appearance and this damage will increase the probability of introducing plant pathogens onto the seedlings.⁹

Wireworms

Wireworm larvae injure crops by devouring seeds in the soil, thus preventing seedlings from emerging; by cutting off small, underground stems and roots; and by boring in larger stems and roots.¹⁰

ALTERNATIVE CONTROL

Insecticide alternatives

Carbaryl bait is the only alternative to control mole crickets. As was noted previously, mole crickets are commonly found around the perimeter of vegetable fields and migrate into the fields as the growing season progresses and the soil fumigants dissipate off. However, soil fumigants such as 1, 3 dichloropropene + chlorpicrin and chlorpicrin can be used to reduce initial mole cricket infestations when used before or immediately after transplanting.

Three products are available to control wireworms in fresh market tomato production. These are imidacloprid (12 hr REI), dichloropropene (5 day REI), and dichloropropene + chlorpicrin (7 day REI). However, due to restrictions on use of dichloropropene products, imidacloprid would be the alternative insecticide of choice.

Biological alternatives

Biological control alternatives are not cost effective or reliable for adequate control of mole crickets or wireworms at this time.

Cultural alternatives

No cultural activities are available which can completely control mole crickets and wireworms at this time. Transplanting large rather than small seedlings can decrease the likelihood of substantial damage as larger seedlings are more tolerant to damage. Reducing the occurrence of weeds that may colonize in

the field and act as alternate food sources may also limit population growth.

BIOLOGICAL IMPACT OF DIAZINON CANCELLATION FOR FRESH MARKET TOMATOES

Diazinon use in fresh market tomatoes is minimal and often related to very localized insect infestations. Even though 7% of the fresh tomato acreage in Florida is treated with diazinon, loss of this product will only result in 1.3% yield reduction overall.¹¹

ECONOMIC IMPACT OF DIAZINON CANCELLATION FOR FRESH MARKET TOMATOES

Per-acre impacts

A crop budget approach was used to determine the economic impact to tomato producers facing a hypothetical cancellation of diazinon. The focus of this analysis will be Florida, the state most predominantly applying diazinon to fresh tomatoes. Sample production costs were obtained from the University of Florida in order to evaluate potential impacts to a typical Florida tomato grower. These budgets are reflective of the likely incurred costs, but are not based on cost of production surveys.

Average yield and price data were utilized to determine gross returns per acre. Yields in Florida averaged 356 cwt. per acre from 1996-2000 at an average price of \$32.40 per cwt.² Gross revenues from 1996-2000 averaged approximately \$11,534.40/acre. Table 4 presents gross returns, production costs and net cash returns for staked tomato production in southwest Florida. These figures assume an application of about 0.58 pounds of diazinon per acre to control wireworm/mole crickets and the subsequent effects of switching the wireworm/mole cricket control regime to either carbaryl or imidicloprid. Although both chemicals are a likely alternative, production impacts associated with changing the current diazinon pesticide regime to either alternative may lead to yield losses of approximately 1.3%¹¹. EPA data show that average production costs associated with applying diazinon are about \$3.00/acre, whereas the costs of applying carbaryl or imidicloprid are approximately \$10.00/acre and \$60.00/acre, respectively. Assuming application equipment remains the same and no other cultural changes lead to an increase in production costs, the expected impact would be an increase of 233% on insecticide costs when replacing diazinon with carbaryl (5.21 lbs./acre/year) and 1900% for imidicloprid (0.31 lbs./acre/year). The combined negative impact resulting from both yield reductions and input cost increases will be an 8% loss for carbaryl and 11% loss for imidicloprid. The economic burden to growers will amount to losses of \$169.00/acre and \$226.00/acre for carbaryl and imidicloprid respectively. This analysis only reflects applications of diazinon to control mole crickets and wireworms. It should be noted that this analysis evaluates the “worst case scenario” and may likely indicate an upper bound on grower impacts. Imidicloprid, in addition to wireworm control, is used against other insects and the benefits of multiple pest control are not accounted for in this analysis.

Table 4. Gross returns, production costs and net returns to staked tomato production, southwest Florida.¹²

	Base Scenario: Diazion	Alternative: Carbaryl	Alternative: Imidacloprid	% Change
production (cwt./acre)	356	351	351	-1.3
price (\$/cwt.)	32.40	32.40	32.40	
gross revenue (\$/acre)	11,534.40	11,372.40	11,372.40	-1.3
insecticide costs (\$/acre)				
diazinon	3.00			
carbaryl		10.00		70
imidacloprid			60.00	95
other:	433.99	433.99	433.99	
other pre-harvest costs (\$/acre)	3807.19	3807.19	3807.19	
harvest costs (\$/acre)	4998.00	4998.00	4998.00	
total operating costs (\$/acre)	9242.18	9249.18	9306.18	
NET CASH RETURNS (\$/acre)	2,292.22	2,123.22	2,066.22	-8 -11

Source: Food and Resource Economics Department, IFAS, University of Florida and BEAD Data

Industry Impacts

Diazinon is applied on 7% (see Table 3, above) of the bearing fresh tomato acreage in Florida, or about 8,664 acres. Yield losses associated with diazinon cancellation will be about 1.3%. Cost per acre impacts resulting from a change to imidicloprid would be about \$7.00 to \$53.00 per acre. Given the range of the per acre economic burden facing growers (see above), annual industry losses can be calculated by multiplying the net economic loss facing growers by the number of acres treated with diazinon. This gives an estimate of industry losses ranging from \$1,464,216 to \$1,897,416 annually. Average gross revenues from fresh tomato production in the state of Florida exceed one billion dollars

(see Table 1, above). Comparing industry losses with gross revenues for the industry, the economic burden associated with a regulatory decision may only lead to losses ranging from 0.1% to 0.2% of the gross value of Florida fresh tomatoes.

CONCLUSIONS

Only a 1.3% yield loss impact will be felt in fresh tomato production from the cancellation of diazinon. Imidacloprid should adequately control wireworms. While imidacloprid is more expensive than diazinon, growers report that at-plant application of imidacloprid reduces the total number of necessary foliar insecticide applications for tomato production. Growers believe that using imidacloprid results in a 14 percent reduction in production costs due to the multiple pest control benefits. These added benefits from the multiple pest control capabilities associated with imidacloprid are outside the scope of this analysis. Growers also believe that multiple pest control benefits could lead to an additional 13 percent increase in yield.¹³ Therefore, the only impact associated with diazinon cancellation will result from mole cricket infestations.

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¹³ Tomato Pest Management and Pesticide Use Survey for 1997. UF Pesticide Information Office; report in production.

APPENDIX

Area, Production, and Sales of commercial fresh market tomatoes in 2000.

State	Area Harvested (Acres)	Production (1,000 cwt)	Value per Unit (\$ per cwt.)	Value of Sales (\$ 1, 000)
Alabama	1100	242	25.90	6,267.80
Arkansas	1500	150	26.00	3,900.00
California	42800	11128	30.00	333,840.00
Florida	42000	15540	32.60	506,604.00
Georgia	3900	1365	24.50	33,442.50
Indiana	1600	248	56.30	13,962.40
Louisiana	n/a	n/a	n/a	0.00
Maryland	1900	247	34.00	8,398.00
Massachusetts	450	52	90.00	4,680.00
Michigan	2300	408	44.40	18,115.20
New Jersey	3900	720	41.70	30,024.00

New York	3300	540	56.80	30,672.00
North Carolina	2200	696	30.00	20,880.00
Ohio	3000	1125	20.00	22,500.00
Pennsylvania	4,400	840	30.00	25,200.00
South Carolina	3200	884	23.00	20,332.00
Tennessee	3400	1131	31.00	35,061.00
Texas	1400	182	32.30	5,878.60
Virginia	3800	1287	24.00	30,888.00
Other states (CT + HI)	950	179	53.00	9,487.00
Total	128720	36964	31.40	1,160,669.60

Summary of diazinon benefit information for fresh tomatoes.

	Fresh Tomatoes
Total acres	123,772
Region(s)	Florida
Percent crop treated	7% (downward trend since 1996)
Critical Uses	mole cricket wireworms
Alternatives(s)	carbaryl bait (mole cricket) imidacloprid (wireworms)
Formulation(s)	Flowable
Application(s)	at plant (broadcast or drench)
Yield loss assessed (range)	-1.3%
Economic Impact	\$1,464,216 to \$1,897,416
Profit Impact	
Other information	